Assignment #6

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Ch16.1

Elements of a Bugs model: list the elements of the model on page 370 by category: modeled data, unmodeled data, modeled parameters, unmodeled parameters, derived quantities, and looping indexes (as in Figure 16.4).

```
model {
for (i in 1:n){
y[i] ~ dnorm (y.hat[i], tau.y)
y.hat[i] <- a[school[i]] + b*x[i]
}
b ~ dnorm (0, .0001)
tau.y <- pow(sigma.y, -2)
sigma.y ~ dunif (0, 100)
for (j in 1:J){
a[j] ~ dnorm (a.hat[j], tau.a)
a.hat[j] <- g.0 + g.1*T[j]
}
g.0 ~ dnorm (0, .0001)
g.1 ~ dnorm (0, .0001)
tau.a <- pow(sigma.a, -2)
sigma.a ~ dunif (0, 100)
}
```

The Answer

```
Modeled data: y
Unmodeled data: n, J, school, x, T
Modeled parameters: a
Unmodeled parameters: b, g.0, g.1, sigma.y, sigma.a
Derived quantities: y.hat, tau.y, a.hat, tau.a
Looping indexes: i,j
```

Ch16.2

Find all the errors in the following Bugs model:

```
model {
for (i in 1:n){
y[i] ~ dnorm (a[state[i]] + theta*treat[i] + b*hispanic, tau.y)
}
theta ~ dnorm (0, .0001)
b ~ dnorm (0, 1000)
for (j in 1:J){
a[j] ~ rnorm (mu.a, tau.a^2) }
mu.a ~ dnorm (0, .0001)
tau.a <- pow (sigma.a, -2)
sigma.a ~ dunif (0, 100)
tau.y <- pow (sigma.y, -2)
sigma.y <- dunif (0, 100)
}
```

The Answer

```
1. The 'a[state[i]] + theta*treat[i] + b*hispanic' function should be written outside th
e dnorm().
2.The prior distribution of b should be dnorm (0, .0001), which means mean = 0 and stand
ard deviation = 100 (thus, they each have inverse-variance = 10^(-4)).
3. tau.y <- pow (sigma.y, -2) and sigma.y <- dunif (0, 100) should be moved to the front
 of the second for loop.
4. The distribution of a[j] should be dnorm(). Because dnorm() gives the density, and rn
orm generates random deviates.
```

The revised version

```
model {
  for (i in 1:n) {
    y[i] ~ dnorm(y.hat[i], tau.y)
    y.hat[i] <- a[state[i]] + theta*treat[i] + b*hispanic
  }
  theta ~ dnorm(0, .0001)
  b ~ dnorm(0, .0001)
  tau.y <- pow(sigma.y, -2)
  sigma.y ~ dunif(0, 100)
  for (j in 1:J) {
    a[j] ~ dnorm (mu.a, tau.a)
  }
  mu.a ~ dnorm(0, .0001)
  tau.a <- pow(sigma.a, -2)
  sigma.a ~ dunif(0, 100)
}
```